

A Qualitative Study of Information challenges in the Cloud

(Full Research)

Elaine George

School of Information Technology and Mathematical Sciences
University of South Australia
Australia

Email: elaine.george@unisa.edu.au

Dr Jing Gao

School of Information Technology and Mathematical Sciences
University of South Australia
Australia

Email: jing.gao@unisa.edu.au

Abstract

This paper explores the modified information management and information governance challenges faced by organizations when shifting from traditional on-site model to the cloud. The specific cloud information management and governance challenges, often ignored by businesses due to their experience in traditional information governance and outsourcing, have the potential to threaten the sustainability of a business that is new to the cloud. As cloud solutions from powerful vendors are being thrust at unsuspecting customers, it is imperative that organizations understand information related changes required in the cloud to ensure regulatory compliance. A series of qualitative interviews involving expert practitioners has helped investigate the information challenges; and the barriers and drivers of cloud adoption in the current market with some unexpected observations.

Keywords

Information Management, Information Governance, Cloud Computing, Qualitative Interviews.

INTRODUCTION

Cloud services offer many benefits to organizations like reduced operational costs, access to superior infrastructure, flexibility and adaptability and is seen by many as a transformative innovation in information technology for people, businesses and governments (World Economic Forum 2010). The emergence of Big Data analytics within the organization along with the heterogeneous nature of the cloud create unexpected complexities in Information Management (IM) and Information Governance (IG) in the form of security and data privacy, data quality and metadata management, regulatory compliance etc. among several other issues. It may take months of time consuming effort to ensure the accuracy and appropriateness of data maintained within the cloud based system. Even though cloud vendors try hard to address issues of concern, the final accountability and liability for data breaches rests with the organization that put its data in the cloud in the first place (Reza and Karodiya 2013).

The research described in this paper will be used to investigate how traditional IM and IG challenges may require a modified approach in the cloud due to the very nature of the deployment model (cloud). Cloud vendors and cloud users need to work alongside regulatory bodies to address governance risks in order for the cloud industry to grow. The main objective of the paper is to clarify the main IM and IG priorities of organizations shifting to the cloud; and its main motivations and barriers - as a precursor to developing the best possible approach for adopting a cloud based business model in the future. With this aim in mind, an exploratory study was conducted using open-ended interviews with experts to investigate whether or not practitioners find traditional IM/ IG approach as a barrier to adoption of the cloud and why.

The remainder of this paper will review the relevant literature on IM/ IG issues in cloud and traditional on-site business in detail. The subsequent section introduces the research design and data collection from 22 IM/ IG experts. This is followed by data analysis of information collected from the initial round of exploratory questions

and the follow up round with feedback; then the results and implications of the research are discussed. The paper concludes with some observations about the overall findings, following which, the limitations and future research directions are highlighted.

BACKGROUND

The dynamic and heterogeneous nature of cloud requires several components owned by different vendors to interoperate to deliver successful services as per Abbadi (2011); this can make it extremely difficult to trace origins, causes and effects of any IM/ IG breach within the cloud infrastructure.

Research Aim

This research is important because it is the cloud industry is relatively new and many business executives, as well as Information Technology (IT) professionals are taking first tentative steps into the world of Social Media for business, Big Data Analytics and Mobile Commerce, all enabled by the powerful capabilities offered by the cloud. Accountability for their business initiatives must be set in order to boost customer confidence and to ensure success of such initiatives.

The paper answers the certain exploratory questions, the data from which will in the future be used to extend traditional IM/ IG approaches to successful implementation in the cloud –

RQ1: What are the significant IM issues when organisations move enterprise information to the cloud?

RQ2: What are the significant IG issues when organisations move enterprise information to the cloud?

RQ3: What are the drivers and barriers for adoption of cloud?

Following the literature review, a qualitative study comprising of two rounds of interviews was conducted to answer the above mentioned Research Questions (RQ). Further description is provided in later sections.

Defining IM, IG and the Cloud

The Australian Computer Society (ACS) says that Enterprise Information Management (EIM) is the technology and practice of maximizing the value of information while minimizing its risks. Gartner, a leading IT research and advisory firm, defines EIM as “an integrative discipline for structuring, describing and governing information assets across organizational and technological boundaries to improve efficiency, promote transparency and enable business insight”. IG is defined as “specification of decision rights and an accountability framework to encourage desirable behaviour in the valuation, creation, storage, use, archival and deletion of information. It includes the processes, roles, standards and metrics that ensure the effective and efficient use of information in enabling an organization to achieve its goals” (Logan, 2010).

The actual process of migrating enterprise data to the cloud exacerbates a problem that IT has long faced: before the team can determine which applications to move to the cloud, Lasschuyt and van Hekken (2001) claim that a complete understanding of a company’s assets, along with the ability to connect that understanding to available data on actual contract terms, licensing and patterns of usage. Cloud technology emerged as a revolutionary new concept, defined as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”, according to the National Institute of Standards and Technology (O’Brien and Yasnoff 1999). Ensuring compliance to legal and regulatory requirements has been achieved through traditional on premise IM/ IG over many years of trial and error; however, in a complex cloud environment, this remains a challenge for information professionals as the cloud market evolves, exposing huge vulnerabilities of keeping data in the cloud

Related Research - Impact of cloud on IM and IG

Cloud based systems are structured quite differently from other distributed systems like grids as per Abbadi and Lyle (2011) and therefore create new/ modified challenges in managing information like managing Information Quality (IQ) of data collected from a variety of sources, metadata management in the absence of globally accepted and interoperable cloud metadata standards and information security management. A look at some of the established frameworks and models for traditional on-site IM/ IG like those from the Data Management Association (DAMA), the Data Governance Institute (DGI), and IBM helps identify the major focus areas to investigate in the cloud. Thus the literature review included extensive study of available processes and standards that have proven to work well for on-site management and governance of information to provide a list of issues that must be evaluated in the cloud based context.

Some of the identified problems are around Information Quality - quality of data in transit, and reference data errors contribute to the problem (Adelman 2005; Chapman 2005); Information Security - virtual machine attacks, data loss etc. (Bair 2011; PricewaterhouseCoopers 2008); Information Privacy and confidentiality (Culnan and Armstrong 1999; Hein 2014); Metadata Management – metadata about security and integrity constraints, access information, cloud instance metadata etc. needs to be captured (Aktas et al. 2005; Bennet and Cloud 2010); and Information Lifecycle Management (like storage, deletion and archival of data in the cloud) - (Casassa and Beato 2007; De Grasse 2013) among others – this provides just a few examples and not an exhaustive list. Some IG concerns like the lack of appropriate and commonly accepted cloud IG framework/ methodology in practice, lack of cloud standards, compliance issues etc. are also discussed in literature by Hein (2014); Koutamanis et al. (2007); Shepherd et al. (2010); Tero (2010). Big Data problems that include retention, integration and ensuring validity have been touched upon by Adrian (2009); Kandukuri et al. (2003); Kisker (2012) among others. It must be noted that while lots of IG concerns relate to the privacy and security issues, the recent Big Data related studies suggest that the ultimate objective of successful design and implementation of IG should allow organisations to exploit the value within organisational data and information to support value creation activities such as business innovation. This study takes this important perspective into consideration while exploring the cloud-related IG issues. None of currently available studies have offered a consolidated look at the priorities of organizations shifting to the cloud. While not all aspects of managing and governing information will be affected within the cloud, it is expected that the way many common IM (e.g. information security, business continuity etc.) and IG (e.g. data ownership, data loss etc.) concerns are resolved in the cloud will vary in both scope and technique.

A lot of focus in recent research literature has been around cloud based Information Security (Malik and Nazir 2012). But as Bahl and Wali (2014) point out, Information Security is a part of IG and IG itself, is a component of IM as found in the DAMA-DMBOK Framework. Information Security goes beyond being a mere technical issue – the way people use the technology and the manner in which an organisation assesses its security concerns are very much part of the IM context. Thus Information Security must also be looked at from an IM and governance point of view. The available research from Cloud Security Alliance (CSA), Information Systems Audit and Control Association (ISACA), and several private and public organisations lay much emphasis on Information Security aspects of the cloud.

The discussion of IG barriers to adoption raised some interesting and contrasting opinions like “I really don’t perceive any obstacle to Information Governance in the cloud. I just need to be clear here, Information Management in general will have implications when cloud-based architecture is involved, however the governing of the data should not be affected.” Another participant stated that “In my experience, much of the concern over “cloud computing” grows out of the fear of the unknown. Much of this concern is outdated, exaggerated or based on a lack of understanding. And in many cases, moving to a vendor actually exposes weaknesses in the IT teams planning and maturity.” On the other hand, looking at available online literature, one finds observations like “I’ve been looking at the cloud for a long time, and it’s not as simple as all the vendors want to make it seem,” says Rosen, CIO of the National Institute of Arthritis, Musculoskeletal and Skin Diseases at the National Institutes of Health in Bethesda, Md. (Pratt 2011); Dean Gonsowski, global head of information governance at Recomind says, “It is this overreliance on employee-based governance that is giving organizations a false sense of security. While it’s positive that organizations recognize the need for information governance, many are still not taking the requisite steps to truly govern their information in a proactive manner. In fact, many are still in the dark about governance and don’t have a full sense of the data deluge they are currently facing.” (Recomind 2013). “In the past, even if you didn’t do governance quite right, everyone and everything was still in the same sandbox. But now you can’t rely on that.” (Stackpole 2012). It would seem that the contrasting opinions depend not only on individual understanding and experience in cloud computing, but also on whether or not practitioners believe that some of the concerns raised really do fall under the IM/ IG domain.

RESEARCH METHODOLOGY

Qualitative research is becoming more and more popular due to the valuable insight it provides into the perspectives of the study population. Myers (2009) points to several differences between qualitative and quantitative research methods. Qualitative research is also useful for providing complex descriptions of the research issue as perceived by the interviewed experts. The choice of research method should support validity of data and theory building as described by Mintzberg (1979) and Eisnerhardt (1989). Based on the taxonomy of theory types in Information Systems research tabulated by Gregor (2006), the observations from this research will contribute towards the analysis theory type where relationships specified may be classificatory and not causal in nature. Quantitative research was not employed so as to retain the social context within which the responses were made because according to Kaplan and Maxwell (1994), the goal of understanding the phenomenon from the participant’s perspective and its social context is lost when quantitative methods are

applied to textual data. Retaining the social context and richness of the description given by participants is necessary for data validity and theory building as mentioned by Mintzberg (1979) and Eisnehardt (1989).

Research Method

In this research, exploratory nature of research was employed as it was found to be the most appropriate and suitable research design that addresses the uncertainty (Cua and Garrett 2009) surrounding IM/ IG issues within the cloud context. The qualitative interview questions enabled participants to expand on their experiences providing rich and detailed data for analysis. As supported by (van Wyk 2012), exploratory studies have a high level of flexibility and are useful for setting the boundaries of the environment relevant to this research within which the issues exist. Interviews are useful in collecting detailed information that is unavailable through other methods like surveys. Turner (2010) makes the case for structured open-ended interviews where the phrasing of questions for each participant is identical, but the responses are open-ended due to the type of questions asked, allowing participants to offer their opinions in detail and allowing the researcher to ask follow up questions. Open ended questions also enable participants to offer in-depth and meaningful responses. The motivation for using exploratory research was to use participant response to develop the case for IM/ IG in the cloud.

Data Collection

Experts on cloud computing (academics, consultants, practitioners from organizations who have used cloud services extensively were chosen for the interviews. The method requires the use of questionnaires with the facility of feedback as explained by Rowe, Wright & Bolger (1991) and is useful where experts may be geographically scattered and unable to come together within a specified time for a direct interview as per Woudenberg (1991). Walsham (1995) says it is advisable to keep a flexible view of available data, so that, with every iterative round of data collection and analysis, the initial theories and assumptions can be revised or even completely rejected. The use of open-ended questions, according to Mack et al (2005), also helps evoke responses from participants that may be meaningful to the participant, elaborate and explanatory in nature, and sometimes, the response may be totally unanticipated by the researcher.

The two rounds were necessary as the interviews were not face-to-face. Due to extreme time management issues of the busy experts, it was decided that an online questionnaire was the best possible means of collecting the data. The possibility of a panel/ focus group interview was also rejected for reasons of time and expense management and possibility of bringing geographically scattered experts for a non-profit research interview. When the data from this first round was analysed, the need for a second round rose in order to clarify the first round responses and receive any feedback or comments that the experts may have thought of. This was again conducted through the online medium. The Delphi Study technique was considered and rejected at this stage as this first stage of research is about testing the waters, checking whether issues worth examining really exist in this space and to ask feedback questions based on the issues raised in the first round; rather than to develop possible consensus by experts on information management and governance issues. A Delphi study may be more useful at a later stage, when issues have been identified and the objective of seeking consensus would not limit the nature of questions raised in subsequent rounds.

Selection of participants and communication

In order to identify the most suitable participants, the power of corporate social media like LinkedIn was employed. Specifically, expert sampling was employed based on particular characteristics, like experience of atleast 5 years in information management domain with knowledge of cloud computing concepts. Extensive analysis of people with IM experience of at least 5 years was done and followed up by individual information from corporate websites. Additionally, snowball sampling using referrals from already qualified experts were accepted and verified. Table 1 shows the job profiles of respondents; their individual experience in this area ranges between 5 and 21 years.

A total of 62 experts were initially chosen from LinkedIn and expert recommendation. These were invited to participate in the study via e-mail based questionnaires. 27 accepted the invitation and were forwarded the first questionnaire. 22 experts covering North America, Europe, Australia and Asia actually responded with detailed answers to the exploratory questions. 14 experts responded to feedback questions in round 2. The others could not participate within the research timeframe due to their work commitment.

Table 1. Participant Profile

Organisation Type	Number of participants	Job Title
-------------------	------------------------	-----------

Industry Practitioners	13 (Round 1) 8 (Round 2)	Document and Information Management Specialist Head of Group Data Management Head of Data Management Director for Records and Information Management Director of Data Governance Data Strategy and Standards Manager Senior researcher (Cloud and Security) Information Manager and Chief Enterprise Architect Executive and Technology Leader (Round 1 only) Enterprise Data Champion (Round 1 only) Solution Architect (Round 1 only) Information and Data Management Leader (Round 1 only) Director, EIM Solutions (Round 1 only)
IT Consultants	5 (Round 1) 2 (Round 2)	Data management Consultant Principal Founder and President Managing Partner (Round 1 only) Principal Consultant (Round 1 only)
Academics	4 (Round 1) 4 (Round 2)	Professor of Computer Science and Software Engineering Professor of Information Science Research Unit Leader Professor of Computing Science

DISCUSSION

The collected data from Round 1 through e-mails and online questionnaire was documented, organized and categorised into concepts by identification of themes. Due to space limitations, the descriptive responses from the interviews have not been put-up; instead the follow-up round was used to categorize the identified themes (Tables 2 and 3) into proposed groupings of highest, medium and lowest priorities. Two questions on priority ranking are discussed below along with four descriptive questions briefly analysed. The priority reflects the most urgent changes required to mitigate risks arising from the shift to the cloud. The mean value has been calculated as Mean= $(x_1w_1 + x_2w_2 + x_3w_3 \dots x_nw_n)/n$, where w = weight of answer choice (highest=1; medium=2; lowest=3); x = response count for answer choice (second line of each cell); and n = number of participants. As the lowest priority has the highest weight, it is to be noted that the issue with the lowest weighted average will have highest priority, while the issue with the highest weighted average is expected to have the lowest priority. The list of issues and factors developed at the end of the first round of interview is based on respondent output as well as literature review of the most relevant concepts.

IM issues classified according to investment priority

In order to have a theoretical basis for identifying the significant IM challenges in the cloud, it was decided that the popular Data Management International's Data Management Body of Knowledge (DAMA-DMBOK) 2009 Functional Framework could be used for its elaborate view of IM functions and best practices, without going into extensive details on methods and techniques. The framework includes Data Governance as a theme which made it possible to use a single framework as opposed to a range of vendor specific frameworks for analysis. Since IG touches upon every aspect of IM it its capacity to offer structure and support to information related processes, the researchers mapped participant responses to the popular DAMA-DMBOK Functional Framework for traditional on-site IM which also includes IG as its component.

Question: If you have a limited access of resources (funding, time, staff etc.), how would you prioritize your investment in modifying/ customizing the following urgent IM issues to meet cloud based requirements. (In the priority column, the second reading refers to the number of people (n) that chose a particular option)

Table 2. IM issues in the Cloud

Issue	Highest priority (weight = 1)	Medium priority (2)	Lowest priority (3)	Total-(n)	Average Rating-
Data Governance	78.57% n = 11	21.43% n=3	0% n=0	14	1.21
Data Security Management	85.71% 12	14.29% 2	0% 0	14	1.14
Reference and Master Data Management for staff	21.43% 3	21.43% 3	57.14% 8	14	2.36
Data warehousing and BI management	14.29% 2	35.71% 5	50% 7	14	2.36
Document and content management	14.29% 2	42.86% 6	42.86% 6	14	2.29
Metadata management	23.08% 3	61.54% 8	15.38% 2	13	1.92
Data quality management	35.71% 5	42.86% 6	21.43% 3	14	1.86
Data Architecture management	7.14% 1	42.86% 6	50% 7	14	2.43
Data development	0% 0	14.29% 2	85.71% 12	14	2.86
Database operations management	0% 0	14.29% 2	85.71% 12	14	2.86
Vendor management practices	35.71% 5	35.71% 5	28.57% 4	14	1.93
Awareness programs and training	23.08% 3	53.85% 7	23.08% 3	13	2.00

*n - The second row of numbers in each cell represents the number of people who chose that option

As observed from Table 2, data security management (for which cloud frameworks are already in place from organizations like the Cloud Security Alliance) followed by data governance receives the highest priority. This creates a visible case for developing a Data Governance framework that is specific for cloud based challenges. As is evident, Information Quality; Metadata Management and Vendor management practices have only been given a medium priority by most – a worrying case especially since data governance is a high priority. This leads one to question whether components like information quality are not viewed by practitioners as a necessary part of IG as may be expected.

On the other end, data development and database operations management followed by data architecture management have been assigned the lowest priority. One of the respondents has also offered the explanation for the low priority of above mentioned issues as, “The main differentiating issues of Cloud-based solutions relate to how security, privacy and vendor relationship are managed. Other process investments for effective data governance (Data Inventory, Metadata, Data Quality, MDM, BI, Ownership/Stewardship etc.) are of similar magnitude and importance whether delivered via Cloud or not”.

IG issues classified according to investment priority

By drilling down to the level of activities required in the IG design and implementation under the modified DAMA framework, a number of key activities / issues (as shown in the Table 3) were selected to guide the design of research questions.

Question: If you have a limited access of resources (funding, time, staff etc.), how would you prioritize your investment in modifying/ customizing the following urgent IG issues to meet cloud based requirements –

Table 3. IG issues in the Cloud

Issue –	Highest priority (1)	Medium priority (2)	Lowest priority (3)	Total –	Average Rating –
Developing cloud IG Strategy, Policies and Standards	53.85% n=7	46.15% n=6	0% n=0	13	1.46
Meeting regulatory compliance and audit requirements	85.71% 12	14.29% 2	0% 0	14	1.14
Data security (including protection, privacy, confidentiality and other legal considerations)	85.71% 12	14.29% 2	0% 0	14	1.14
Ensuring secure/ reliable data access/ availability/ location/ sovereignty	61.54% 8	23.08% 3	15.38% 2	13	1.54
Ensuring data integrity and data quality	46.15% 6	30.77% 4	23.08% 3	13	1.77
Managing data retention and archival	7.69% 1	53.85% 7	38.46% 5	13	2.31
Developing new organisational roles	0% 0	46.15% 6	53.85% 7	13	2.54
Improving staff skills	21.43% 3	50% 7	28.57% 4	14	2.07
Conducting awareness programs and developing best practice guidelines	28.57% 4	35.71% 5	35.71% 5	14	2.07
Modifying vendor management practices	14.29% 2	50% 7	35.71% 5	14	2.21

*n - The second row of numbers in each cell represents the number of people who chose that option

As far as IG issues are concerned, it is visible from the table 3 that meeting regulatory compliance and audit requirements and data security (including protection, privacy, confidentiality and other legal considerations) are at the top of the list requiring urgent attention, followed by secure access and availability. As one expert put it, “We have typically relied on physical security too much and governance through physical structuring (ie. we tend to manage a database as a unit of governance). Moving to the cloud will cause some rethinking of this - security needs to be understood and trusted at the data level - think DRM for rows in a table. And governance will need to be understood at an entity or group of entities level.” Surprisingly though, developing new organisational roles to fulfil skill gaps created by the shift to the cloud remains the lowest priority, which is in contrast with popular market reports that predict a great demand for cloud and Big Data related skills (Hudson Australia 2013; Hein 2014) in the coming years. It may be that organisations may choose to train their existing staff to take on greater responsibilities which leads to such a difference in the point of view of interviewees as opposed to market observers.

Drivers for shifting the business to the cloud

- Reducing operational costs (n= 18) (“The ‘old’ model was to purchase or lease hardware and software outright and manage them in house. Now, the shift to the cloud provides a perceived value around cost reduction”);
- Flexibility and scalability (n=12) (“Few organisations can actually predict capacity requirements beyond six months”);
- Access to better quality of technology and service offered by specialist vendors (n=7) (“Improvement of service by partnering with dedicated service providers with specialist skills”);

- the need to focus on core business while outsourcing IT (n=5) ("They want the newest model maintained by someone else"); and
- the decision to enter Big Data Analytics stream (4) (Transition toward "knowledge-oriented architecture) are the major 5 reasons for organisations to shift to the cloud. This result was derived from Round 1 of interviews with 22 experts.
- Information Availability; Greater Agility; Competitive advantage; Improve data quality; Meeting some regulatory requirements; Collaboration/ sharing; Influence of technology champion and support for vendor products; Business Vs In-house IT alignment issues were other issues mentioned.

Obstacles that are stopping businesses from making the shift to the cloud

The biggest fears about moving information into the cloud relate to data security (n=8), data access (4), data location and privacy (3 each). It is surprising to see that a dominating concern on blog sites like data sovereignty/ ownership and data retention have not been placed high on the list. Regulatory concerns; Data jurisdiction; A preference for 'wait and watch' leading to late adoption of new technology; Data loss and disaster recovery; data availability; data lifecycle management; data sovereignty; data confidentiality; lack of trust in vendors; cultural barriers; large scale data movement issues; cost of legacy system re-engineering were also mentioned. Consultants claim that there is a perception in the industry that cloud is an IT based solution - a view reinforced by several experts who feel that business teams feel left out and lack full understanding of the implications of cloud deployment. Therefore, companies like to play safe, creating the need for IT teams to 'effectively engage with their business peers to move policy and practice discussions forward'.

Adoption barriers for cloud

Surprisingly, inspite of encouraging predictions, many organizations are still wary of using the cloud for sensitive data. Experts pointed out that a lack of tested frameworks and lack of awareness in general about the cloud contributes to poor adoption in many places. An interesting observation is that often, for a vendor, the decision is based on customer's level of confidence. Instead of convincing a customer to use the cloud, some businesses, like legal firms, are often 'asked to comply with our client's directives for storing their information'. Often the decision about type of media used is driven by customer requirements. The organization's ability to apply its lifecycle management policy to customer information is a major concern. If the cloud user does not have the flexibility in applying it policies on the information stored on the cloud, it may instead opt for in-house solutions. Limitations of vendor lock-in followed by lack of tested framework for cloud based IG as well as lack of awareness are leading barriers to adoption of cloud.

IM/ IG maturity of the organization is a curiously decisive factor. On the one hand, it may be expected that an organization with a well-established IT department and mature IM/ IG practices would be able to shift to the cloud without too much trouble; instead it appears that some organizations would prefer to use traditional on-site business delivery precisely due to its success and convenience. On the matter of cost, if the shift to the cloud requires significant reengineering of legacy systems, it does not offer much benefit in terms of cost savings. Mostly, the experts feel that lack of awareness and the challenge of a transformation shift can be intimidating to many people. Lack of confidence in the organisation's IG maturity in turn stems a lack of confidence in any major changes. As one expert summarised, "The biggest single barrier to successful adoption of Info Governance in the cloud is the readiness for adoption of Information Governance at all!"

IG role in generating or accelerating innovation

Organizations everywhere are engaged in efforts to bolster their level of innovation. Some innovate in specific business functions while a few facilitate innovation across the board. In terms of information management, the explosion of digital data has created challenges in terms of storage costs, legal risks and timely access to information. Robust IG practices can help capture and manage information in the cloud to accelerate innovation. As one of the experts put it, "IG should be a catalyst for creative thinking - information-enabled innovation. It is a stimulus to ask the question "what can we learn from the data that we have?".

On the other hand, innovations in managing and governing information with minimum impact on day-to-day functioning can help cut down costs and make information accessible to the right people at the right time. This question actually received divided responses with about a half of the experts claiming that their focus was on meeting best practice requirements, while several others raised the point of "Re-use of data that is currently hidden in silos" as the most significant contribution of IG towards supporting innovative activities, followed by 'improved data quality'. It would seem, based on this set of experts, that by and large, the role of IG is limited to meeting regulatory requirements and not many view IG as a potential means of generating or accelerating

innovation. This view is clear from an expert comment, “IG is critical in assuring that the information on which the organisation runs is appropriately governed for that business’ environment”, as an answer to this question.

CONCLUSION

As one of the interviewed experts rightly concludes, “IM challenges depend on the business function supported with the solution. With appropriate and proper policies, business rules, processes, systems, and automation in place, governance, quality, security, metadata management, and business continuity do not need to be negatively impacted”. In order to achieve this goal, organizations must re-assess the traditional IM processes they have been following; the traditional data roles they have been assuming; and success factors that they have relied upon to enable IM/ IG in the traditional onsite business environment.

This paper lays the groundwork for effecting such a change by identifying the points of change – the modified aspects of EIM that need to be addressed in order to redesign the existing frameworks and processes. The identification of the priorities assigned to different IM/ IG functions, especially IQ, highlights the need to revisit lessons learnt in the past and to re-evaluate requirements so that a smooth transition into the cloud may be enabled and greater benefits may be realized.

Future work and limitations

Future research can also look into critical success factors for shifting IM in the cloud. The research can be further extended to identify best practices in cloud based IM/ IG. A comprehensive IM framework can help Small and Medium sized Businesses to compete with the ‘big fish’ in the market, while, at the same time it can enable the larger firms to develop processes for sustainable growth and improved agility.

The limitation of this study is the reliance on expert opinion, even though all experts are highly qualified professionals with long-term experience. In the absence of in-depth case studies or end-user input, the study will benefit from future research through multiple case studies across a diverse range of organizations.

REFERENCES

- Abbadi, I. M. 2011. “Toward trustworthy Clouds, Internet scale critical infrastructure,” In Proceedings of the 7th Information Security Practice and Experience Conference, Springer-Verlag.
- Abbadi, I. M. and Lyle, J. (2011). Challenges for Provenance in Cloud Computing. 3rd USENIX Workshop on the Theory and Practice of Provenance, Crete, Greece, 2011. Retrieved 09 August, 2014, from https://www.usenix.org/legacy/events/tapp11/tech/final_files/Abbadi.pdf
- Adelman, S., Moss, L. and Abai, M. 2005. *Data Strategy*, New York: Addison Wesley, pp. 47-72. Retrieved 09 August, 2014, from http://ptgmedia.pearsoncmg.com/images/0321240995/samplechapter/Adelman_ch03.pdf
- Adrian, M. 2009. *Data Retention: The Unrealized Opportunity*. IT Market Strategy. Retrieved 09 August, 2014, from http://rainstor.com/wp-content/uploads/2011/07/Data_Retention.pdf
- Aktas, M.S., Fox, G. and Pierce, M. 2005. “Managing Dynamic Metadata as Context,” In *Proceedings of Istanbul International Computational Science and Engineering Conference*, Istanbul, Turkey.
- Bahl, S. and Wali, O.P. 2014. "Perceived significance of information security governance to predict the information security service quality in software service industry," *Information Management & Computer Security* (22:1), pp. 2-23.
- Bair, J. 2011. The Unique Challenges of Cloud Data Security. BeyeNetwork, 16 August. Retrieved 09 August, 2014, from <http://www.b-eye-network.com/view/15416>
- Bennet, S.C. and Cloud, J. 2010. “Coping with metadata: Ten key steps,” *Mercer Law Review*, pp. 471-489.
- Casassa, M., and Beato, F. 2007. “On Parametric Obligation Policies: Enabling Privacy-Aware Information Lifecycle Management in Enterprises,” In *Eighth IEEE International Workshop on Policies for Distributed Systems and Networks*, Bristol, UK, pp. 51-55.
- Chapman, A.D. 2005. “*Principles of Data Quality, version 1.0.*,” Report for the Global Biodiversity Information Facility, Copenhagen. Retrieved 09 August, 2014, from <http://www2.gbif.org/DataQuality.pdf>
- Cua, F.C. and Garret, T.C. 2009. “Understanding Ontology and Epistemology in Information Systems Research,” IGI Global, Hershey.
- Culnan, M.J. and Armstrong, P.K. 1999. “Information Privacy Concerns, Procedural Fairness, and Impersonal Trust: An Empirical Investigation,” *Organization Science* (10:1), pp. 104-115.
- De Grasse, E. 2013. “The cloud computing industry could lose up to \$35bn due to the NSA disclosures,” The Cloud and e-discovery, 7 August. Retrieved 09 August, 2014, from <http://thecloudandediscovery.com/?p=2086>
- Eisenhardt, K. 1989. “Building Theories from Case Study Research,” *The Academy of Management Review*, (14:4).

- Hein, R. 2014. The 8 Most In-Demand Big Data Roles. CIO.com,. 15 January. Retrieved 09 August, 2014, from <http://www.cio.com/slideshow/detail/135970#slide1>
- Gregor, S. 2006. "The Nature of Theory in Information Systems", MIS Quarterly (30:3), pp. 611-642. Retrieved 09 August, 2014, from <http://heim.ifi.uio.no/~petterog/Kurs/INF5220/NatureofTheoryMISQ.pdf>
- Kandukuri, B.R., Paturi, R. and Rakshit, A. 2009. Cloud Security Issues. In *Proceedings of the IEEE International Conference on Services Computing*, pp. 517-520, Bangalore, India
- Kaplan, B. and Maxwell, J.A. 1994. Qualitative Research Methods for Evaluating Computer Information Systems. *Evaluating Health Care Information Systems: Methods and Applications*, J.G. Anderson, C.E. Aydin and S.J. Jay (eds.), Sage, Thousand Oaks, CA, 45-68.
- Kisker, H. 2012. *Big Data Meets Cloud*. Forbes.com. Retrieved 09 August, 2014, from <http://www.forbes.com/sites/forrester/2012/08/15/big-data-meets-cloud/>
- Koutamanis, A., Halin, G. and Kvan, T. 2007. "Information Standardization from a Design Perspective," In *Proceedings of the 12th International Conference on Computer-Aided Architectural Design Research in Asia*, Nanjing, China.
- Lasschuyt, E. and van Hekken, M. 2001. "Information Interoperability and Information - Standardisation for NATO C2 – a practical approach," In *RTO IST Symposium on Information Management Challenges in Achieving Coalition Interoperability*, Quebec, Canada, pp. 5:1-5:20.
- Logan, D. 2010, "What is Information Governance? And Why is it So Hard, Gartner," 11 January, Retrieved 09 August, 2014, from http://blogs.gartner.com/debra_logan/2010/01/11/what-is-information-governance-and-why-is-it-so-hard/
- Mack, N., Woodsong, C., MacQueen, K.M., Guest, G. and Namey, E. 2005. Qualitative Research Methods: A Data Collector's Field Guide. Family Health International. Retrieved 09 August, 2014, from <http://www.inclentrust.org/uploadedbyfck/file/compile%20resource/Qualitative%20Research/Qualitative%20Research%20Data%20Collector%20Guide.pdf>
- Malik, A. and Nazir, M.M. 2012. Security Framework for Cloud Computing Environment: A Review," Journal of Emerging Trends in Computing and Information Sciences (3:3), pp. 390-394.
- Mintzberg, H. 1979. *The Structuring of Organisations*. Prentice Hall, Englewood Cliffs.
- Myers, M.D. 2009. Qualitative Research in Business and Management, Sage Publications, London.
- O'Brien, D.G. and Yasnoff, W.A. 1999. "Privacy, confidentiality, and security in information systems of state health agencies," *American Journal of Preventive Medicine* (16:4), pp. 351-358.
- Pratt, M.K. 2011. "Feds race to the cloud", Computerworld, 13 July. Retrieved 09 August, 2014, from http://www.computerworld.com/s/article/357387/Feds_begin_race_to_the_cloud
- PricewaterhouseCoopers 2008. "Safeguarding the new currency of business," Global State of Information Security Survey. Retrieved 09 August, 2014, from http://www.pwc.com/gx/en/information-security-survey/pdf/safeguarding_the_new_currency.pdf
- Reza, H. and Karodiya, N. 2013. "Dynamic Architectural Framework for Cloud Computing," Computer Science and Information Technology 1(1), pp. 9-18.
- Rowe, G, Wright, G & Bolger, F 1991, 'Delphi: a re-evaluation of research and theory', *Technological Forecasting and Social Change*, (39:3), pp. 235–251.
- Stackpole, B. 2012. "Governance Meets Cloud: Top Misconceptions", InformationWeek, 5 April. Retrieved 09 August, 2014, from <http://www.informationweek.com/cloud/infrastructure-as-a-service/governance-meets-cloud-top-misconceptions/d/did/1104210>?
- Tero, V. 2010. "Information Governance in the Cloud," White Paper, IDC. Available at - <http://www.emc.com/collateral/analyst-reports/1010-idc-paper.pdf>
- Turner, D.W. 2010. "Qualitative Interview Design: A Practical Guide for Novice Investigators", The Qualitative Report (15:3), May, pp. 754-760.
- Recommind 2013. "Information Governance Gap Revealed Across US and UK Companies," Press Release, 14 November. Retrieved 09 August, 2014, from <http://www.recommind.com/releases/information-governance-gap-revealed-across-us-and-uk-companies>
- van Wyk, B. 2012. "Research design and methods Part 1," *University of Western Cape*. Retrieved 09 August, 2014, from https://www.uwc.ac.za/Students/Postgraduate/Documents/Research_and_Design_1.pdf
- Walsham, G. 1995. "Interpretive case studies in IS research, Nature and Method," *European Journal of Information Systems* (4:1), pp. 74-81.
- World Economic Forum 2010. "Exploring the future of Cloud Computing: Riding the next wave of technology driven transformation." Retrieved 09 August, 2014, from http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture_The_Future_of_Cloud_Computing.pdf
- Woudenberg, F 1991, 'An evaluation of Delphi', *Technological Forecasting and Social Change*, (40:1), pp. 131-150.